

299-W26-06 (A5445) Log Data Report

Borehole Information:

Borehole: 299-W26-06 (A5445)		Site: 216-S-5 Crib			
Coordinates (WA State Plane)		GWL (ft)¹: 207.8	GWL Date: 5/14/2003		
North 133,406.0 m	East 566,463.38 m	Drill Date March 1983	TOC² Elevation 200.083 m	Total Depth (ft) 209.65	Type Cable Tool

Casing Information:

Casing Type	Stickup (ft)	Outer Diameter (in.)	Inside Diameter (in.)	Thickness (in.)	Top (ft)	Bottom (ft)
Welded steel	1.2	6 5/8	6	0.3125	0	192
#20-slot screen		unknown	6	unknown	192	221
Welded steel		unknown	8	unknown		148
The logging engineer measured the 6-in. casing stickup using a steel tape. A caliper was used to determine the outside casing diameter of the 6-in. casing. The caliper and inside casing diameter were measured using a steel tape, and measurements were rounded to the nearest 1/16 in. Six-in. casing thickness was calculated. Casing bottoms are as reported from the well completion summary report (Ledgerwood 1993).						

Borehole Notes:

Borehole coordinates, elevation, and well construction information, as shown in the above tables, are from measurements by Stoller field personnel and Ledgerwood (1993). Zero reference is the top of the 6-in. casing. A reference point survey "X" is located on top of the casing stickup. The borehole was swabbed before logging began, and the presence of radon gas was indicated. Elevated activity was detected on the sample, but the activity had diminished after 30 minutes.

Logging Equipment Information:

Logging System: Gamma 1G	Type: SGLS (35%)
Calibration Date: 04/2003	Calibration Reference: GJO-2003-438-TAR
Logging Procedure: MAC-HGLP 1.6.5, Rev. 0	

Spectral Gamma Logging System (SGLS) Log Run Information:

Log Run	1	2/Repeat	3		
Date	5/14/03	5/15/03	5/15/03		
Logging Engineer	Kos	Kos	Kos		
Start Depth (ft)	209.0	38.0	17.0		
Finish Depth (ft)	16.0	17.0	2.0		
Count Time (sec)	100	100	100		
Live/Real	R	R	R		
Shield (Y/N)	N	N	N		

Log Run	1	2/Repeat	3		
MSA Interval (ft)	1.0	1.0	1.0		
ft/min	N/A ³	N/A	N/A		
Pre-Verification	AG011CAB	AG012CAB	AG012CAB		
Start File	AG011000	AG012000	AG012021		
Finish File	AG011193	AG012021	AG012036		
Post-Verification	AG011CAA	AG012CAA	AG012CAA		
Depth Return Error (in.)	0	N/A	0		
Comments	No fine-gain adjustment.	No fine-gain adjustment.	No fine-gain adjustment .		

Logging Operation Notes:

Zero reference was top of the 6-in. casing. Logging was performed with a centralizer installed on the sonde. Pre- and post-survey verification measurements for the SGLS employed the Amersham KUT (⁴⁰K, ²³⁸U, and ²³²Th) verifier with serial number 118. Before logging began on May 14, 2003, the sonde was run up and down the borehole one time in an attempt to displace any radon gas if present. Prior to the logging on May 15, 2003, the borehole cap was left off overnight to vent possible radon gas.

Analysis Notes:

Analyst:	Sobczyk	Date:	5/19/03	Reference:	GJO-HGLP 1.6.3, Rev. 0
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SGLS pre-run and post-run verification spectra were collected at the beginning and end of the day. The verification spectra were all within the control limits except for AG011CAA and AG012CAB. Post-run verification spectrum AG011CAA was above the upper control limit for the 609-keV full-width at half-maximum value. Pre-run verification spectrum AG012CAB was above the upper control limits for the 609-keV and 1461-keV full-width at half-maximum values. The peak counts per second (cps) at the 609-keV, 1461-keV, and 2615-keV photopeaks on the post-run verification spectra as compared to the pre-run verification spectra for each day were between 1 percent lower and 2 percent higher at the end of the day. Examination of spectra indicates that the detector appears to have functioned normally during logging, and the spectra are provisionally accepted, subject to further review and analysis.

Log spectra for the SGLS were processed in batch mode using APTEC SUPERVISOR to identify individual energy peaks and determine count rates. Verification spectra were used to determine the energy and resolution calibration for processing the data using APTEC SUPERVISOR. Concentrations were calculated in EXCEL (source file: G1GMay03.xls), using parameters determined from analysis of recent calibration data. Zero reference was the top of the 6-in. casing. On the basis of Ledgerwood (1993), the casing configuration was assumed to be a string of 8-in. casing with a thickness of 0.322 in. to 148 ft and a string of 6-in. casing with a thickness of 0.3125 in. to total logging depth (209 ft). Because the thickness of the 6-in. screen is not known, the measured casing thickness of the 6-in. casing was used for the screened interval (192 to 209 ft). The 8-in. casing thickness of 0.322 in. is the published value for ASTM schedule-40 steel pipe (a commonly used casing material at Hanford). Where more than one casing exists at a depth, the casing correction is additive (e.g., the correction for both the 8-in. and 6-in. casings would be 0.322 in. + 0.3125 in. = 0.535 in.). Water correction was applied to the SGLS data below 208 ft. Dead time corrections are required when dead time exceeds 10.5 percent. As the dead time did not exceed 10.5 percent, a dead time correction was not needed or applied.

Log Plot Notes:

Separate log plots are provided for gross gamma and dead time, naturally occurring radionuclides (⁴⁰K, ²³⁸U, and ²³²Th), and man-made radionuclides. Plots of the repeat logs versus the original logs are included. For each radionuclide, the energy value of the spectral peak used for quantification is indicated.

Unless otherwise noted, all radionuclides are plotted in picocuries per gram (pCi/g). The open circles indicate the minimum detectable level (MDL) for each radionuclide. Error bars on each plot represent error associated with counting statistics only and do not include errors associated with the inverse efficiency function, dead time correction, or casing correction. These errors are discussed in the calibration report. A combination plot is also included to facilitate correlation. The ^{214}Bi peak at 1764 keV was used to determine the naturally occurring ^{238}U concentrations on the combination plot rather than the ^{214}Bi peak at 609 keV because it is less affected by the presence of radon in the borehole.

Results and Interpretations:

^{137}Cs was the only man-made radionuclide detected in this borehole. ^{137}Cs was detected near the ground surface (3 to 16 ft) with concentrations ranging from 0.4 pCi/g to 2.5 pCi/g. The maximum concentration of ^{137}Cs was measured at 8 ft. In addition, ^{137}Cs was detected at 53 and 62 ft with concentrations near the MDL of approximately 0.4 pCi/g. After examination of the spectra at these two depths, it was determined that there is no evidence of a photopeak at 662 keV. These reported peaks are probably the result of statistical fluctuation.

The behavior of the ^{238}U log suggests that radon may be present inside the borehole casing. Determination of ^{238}U is based on measurement of gamma activity at 609 and/or 1764 keV associated with ^{214}Bi , under the assumption of secular equilibrium in the decay chain. However, ^{214}Bi is also a short-term daughter of ^{222}Rn . When radon is present, ^{214}Bi will tend to “plate” onto the casing wall and will quickly reach equilibrium with ^{222}Rn . Because the additional ^{214}Bi resulting from radon is on the inside of the casing, the effect of the casing correction is to amplify the 609 photopeak relative to the 1764 photopeak. (The magnitude of the casing correction factor decreases with increasing energy, but gamma rays originating inside the casing are not attenuated.) The reason for variations in radon content between log runs on successive days is not known. Variations in radon content in boreholes are probably related to variations in surface weather conditions. Radon daughters such as ^{214}Bi may also “plate” onto the sonde itself. When this occurs, there is a gradual increase in total counts as well as photopeak counts associated with ^{214}Bi and ^{214}Pb . This phenomenon appears to best explain the observed discrepancy in ^{238}U values based on 609 keV versus those based on 1764 keV during log runs 1 and 2 (repeat).

The presence of radon is not an indication of man-made contamination; it is derived from decay of naturally occurring uranium. As a gas, radon moves easily in the subsurface, and concentrations of radon and its associated progeny can change quickly.

Taking into account the effects of radon, the plots of the repeat logs demonstrate reasonable repeatability of the SGLS data for the natural radionuclides. The reported 662-keV photopeak (^{137}Cs) at 49 ft on the repeat log run was not detected on the original log run.

References:

Ledgerwood, R.K., 1993. *Summaries of Well Construction Data and Field Observations for Existing 200-West Resource Protection Wells*, WHC-SD-ER-TI-005, Rev. 0, Westinghouse Hanford Company, Richland, Washington.

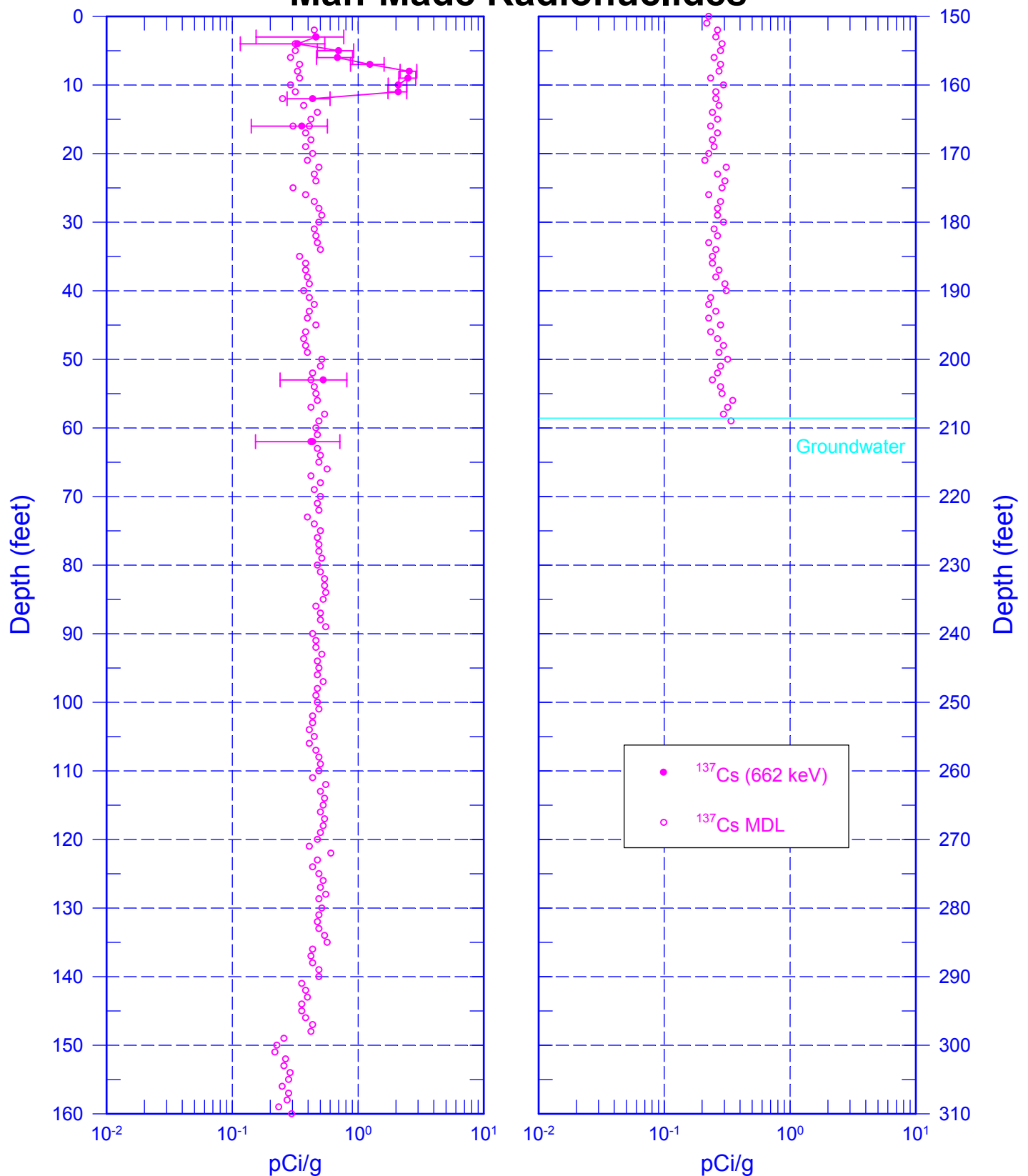
¹ GWL – groundwater level

² TOC – top of casing

³ N/A – not applicable

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Man-Made Radionuclides

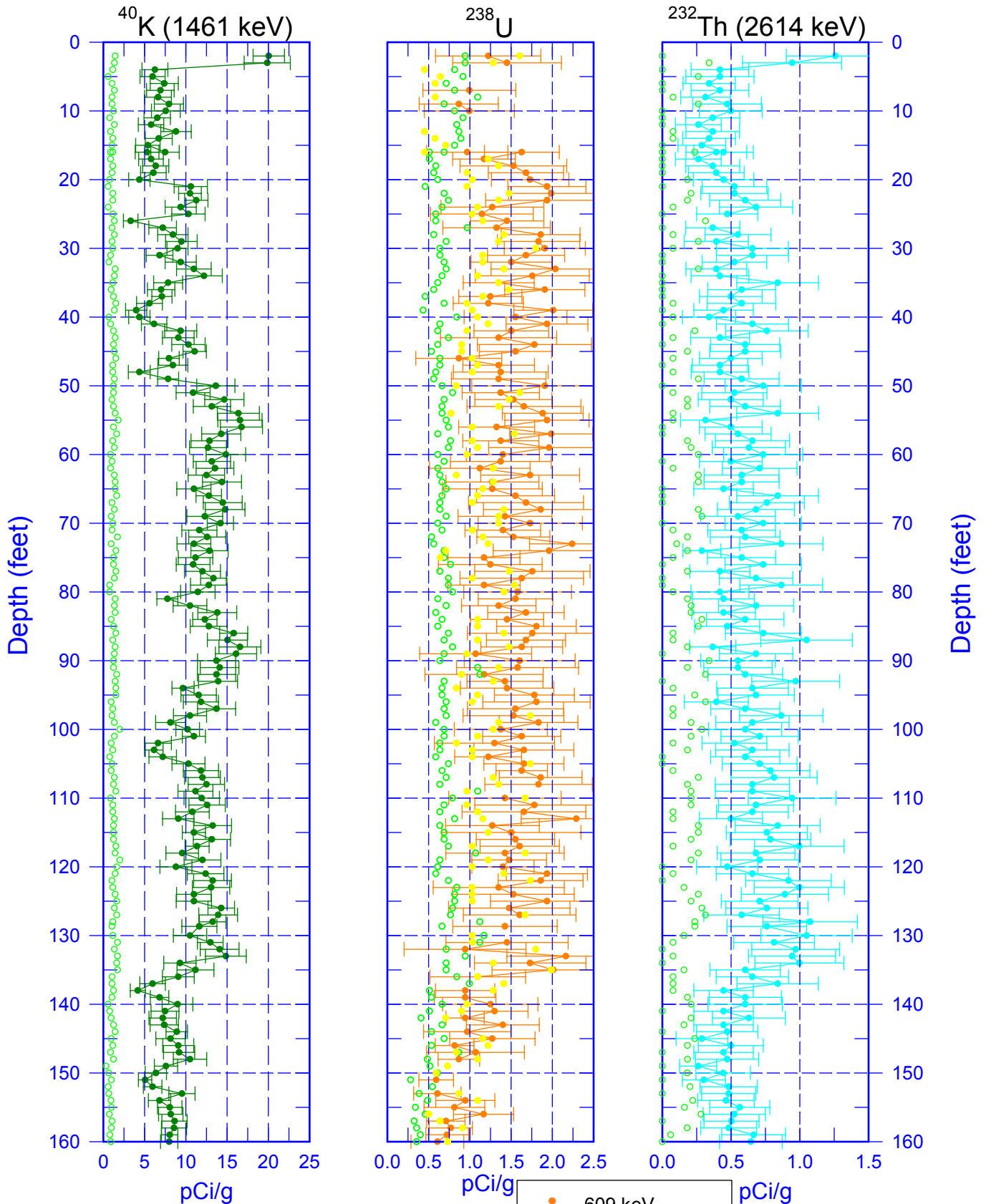


Zero Reference = Top of Casing

Date of Last Logging Run
5/15/2003

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Natural Gamma Logs

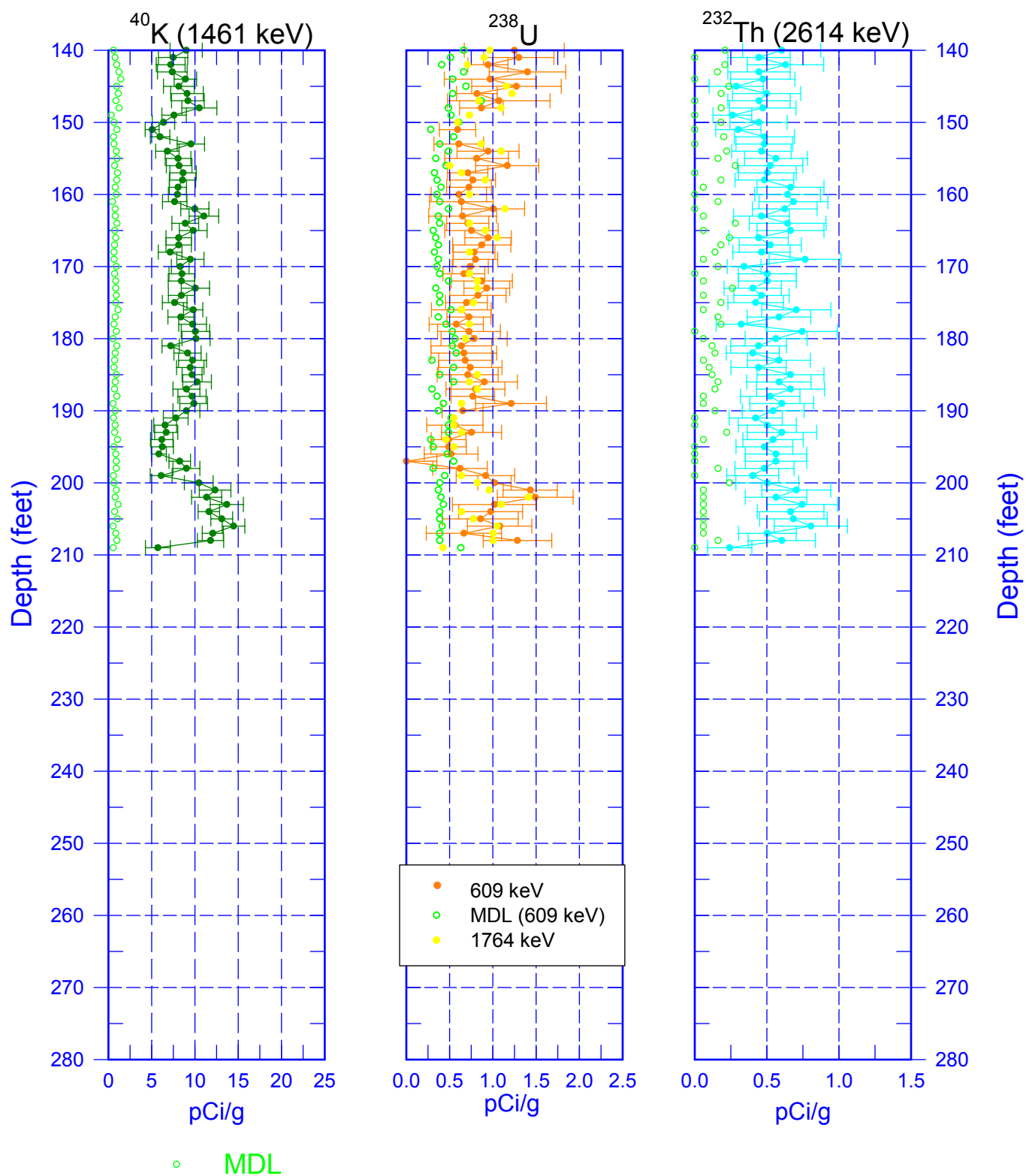


Zero Reference = Top of Casing

Date of Last Logging Run
5/15/2003

299-W26-06 (A5445)

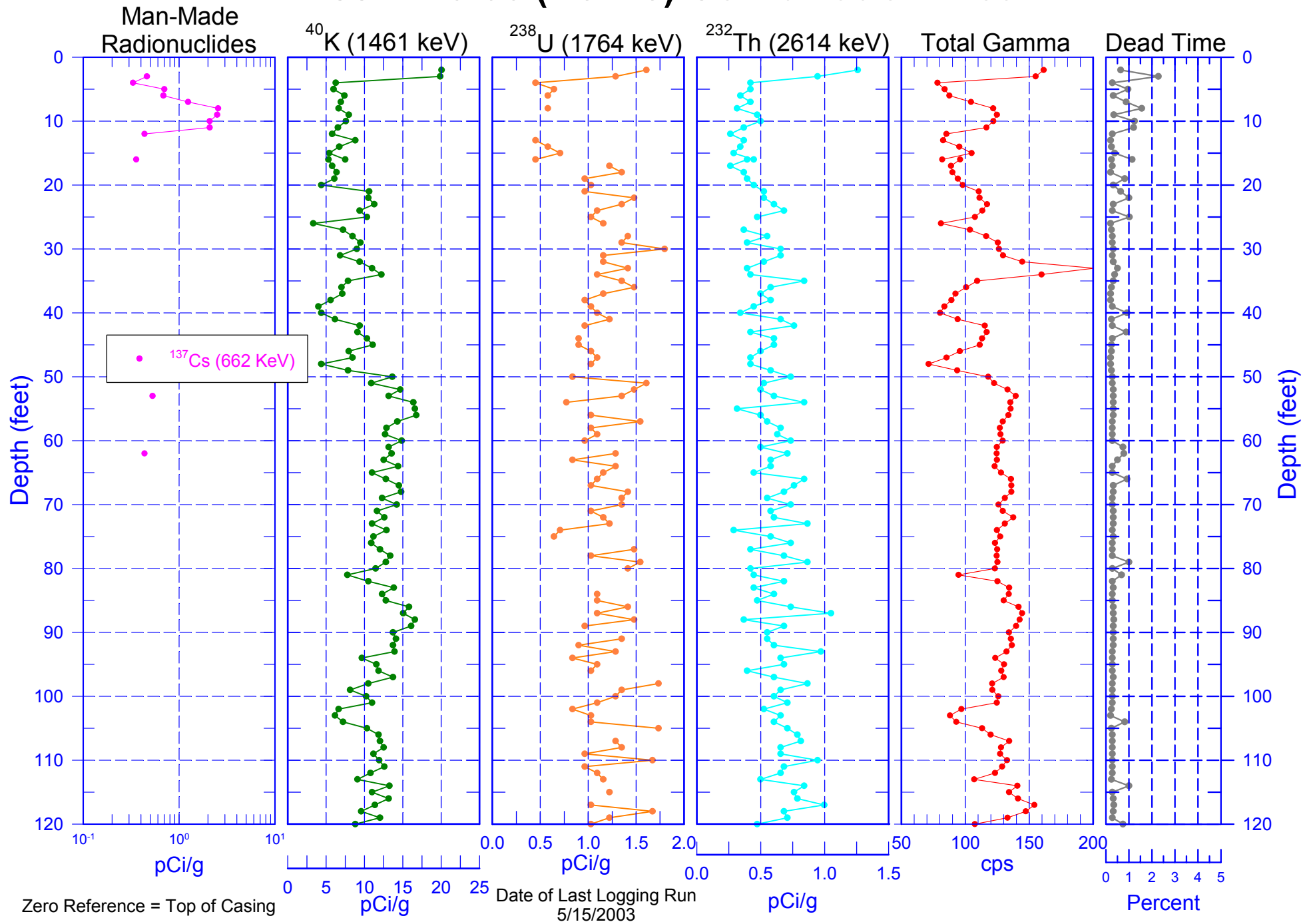
Natural Gamma Logs



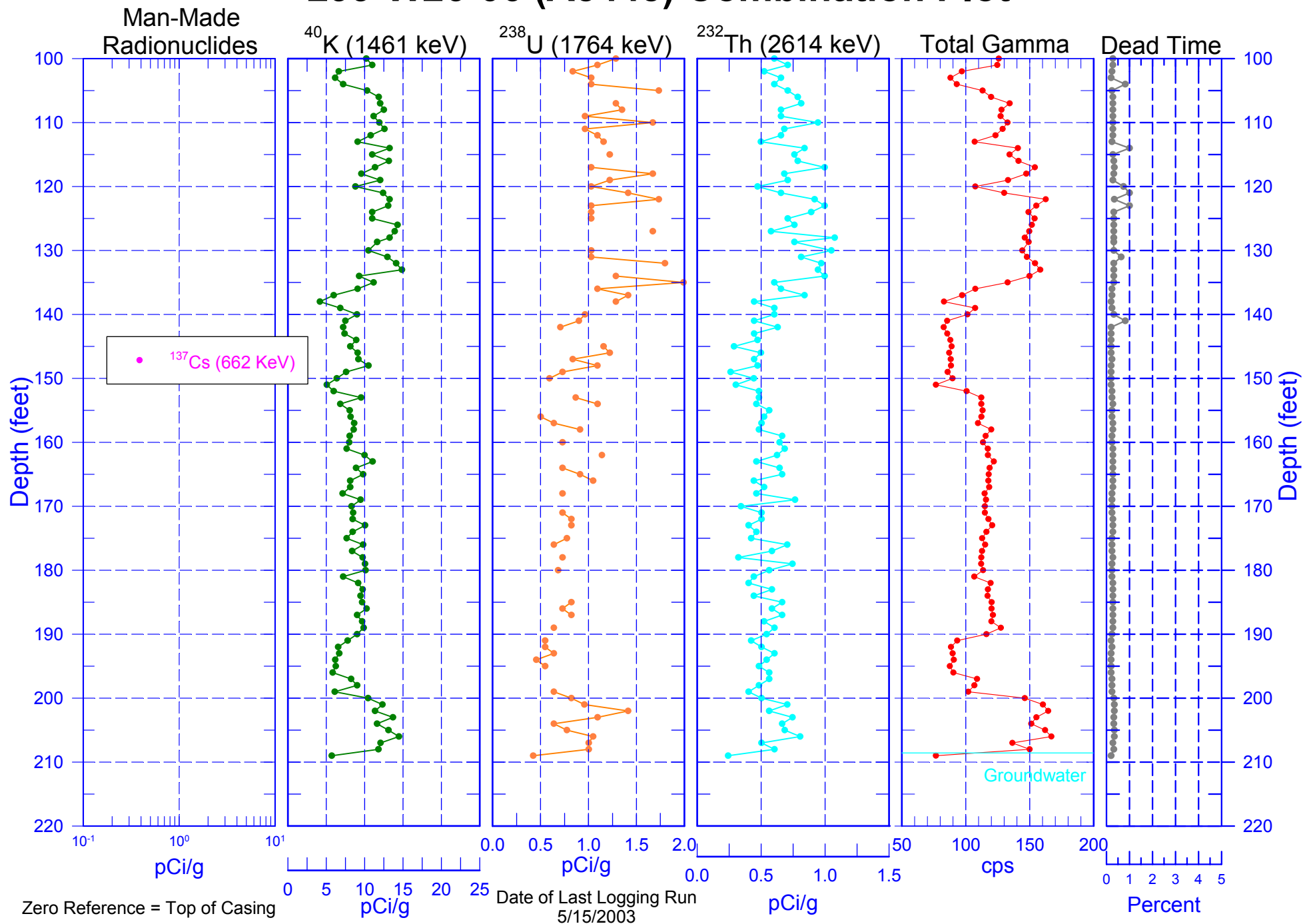
Zero Reference = Top of Casing

Date of Last Logging Run
5/15/2003

299-W26-06 (A5445) Combination Plot

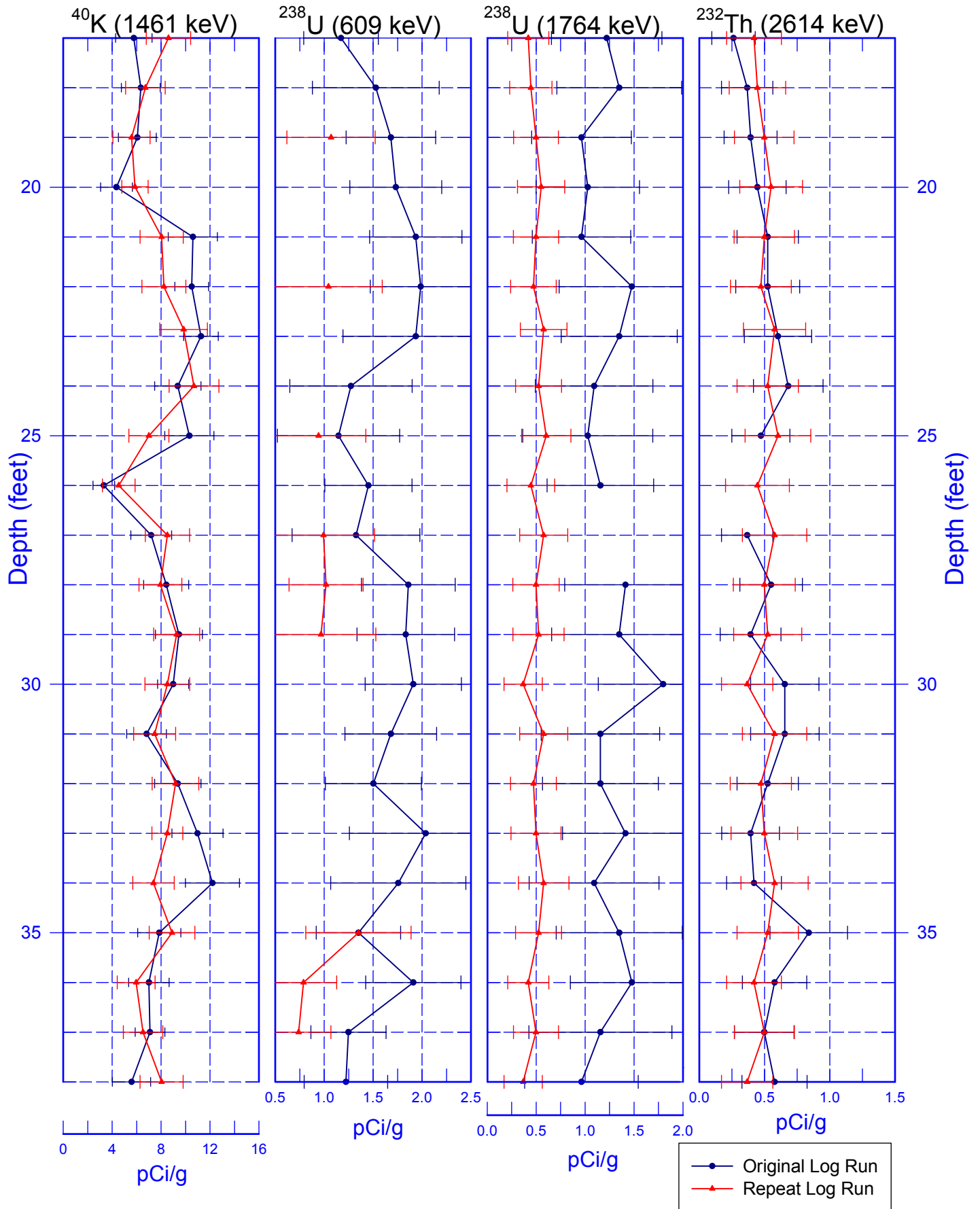


299-W26-06 (A5445) Combination Plot



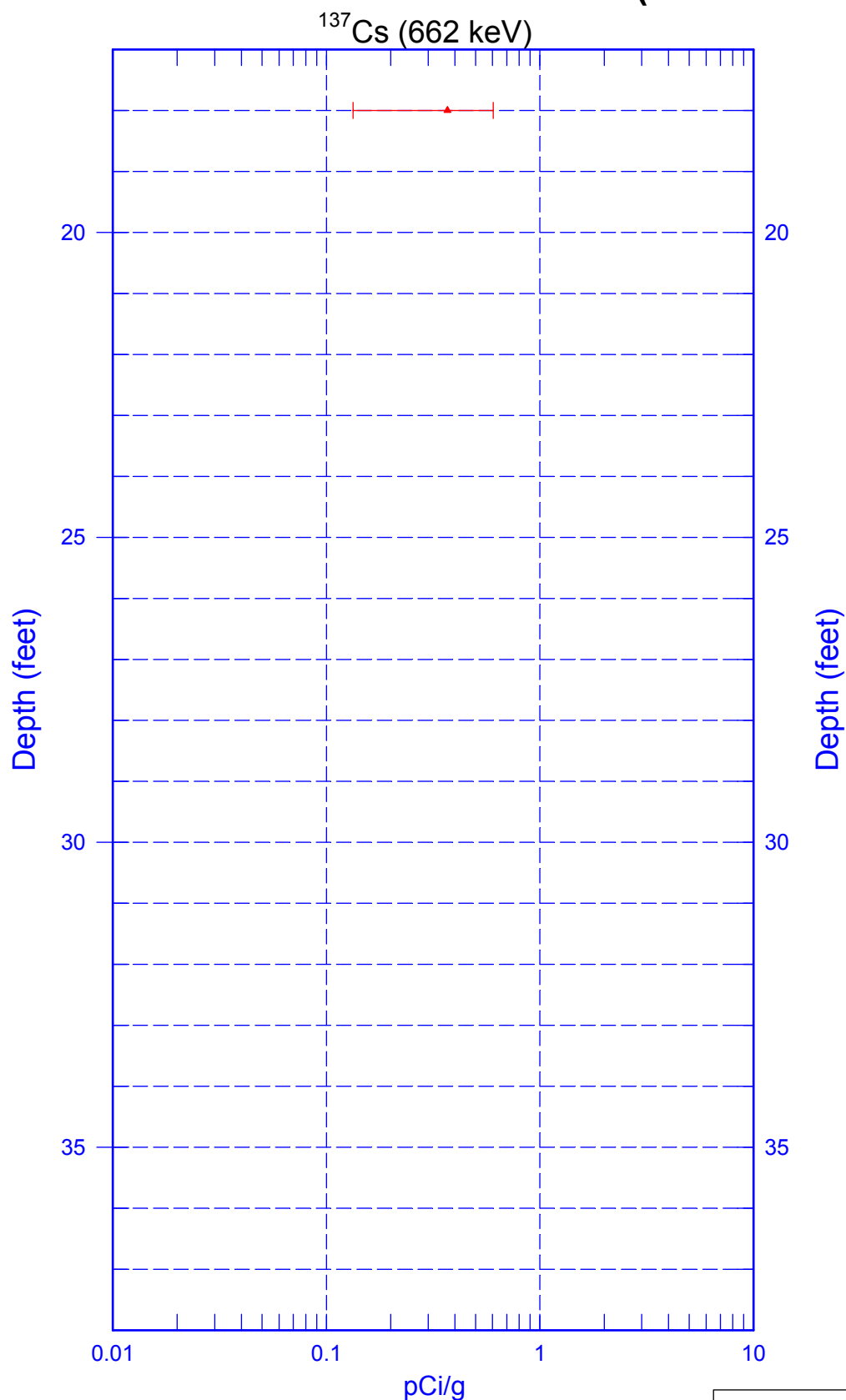
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Rerun of Natural Gamma Logs (38.0 to 17.0 ft)



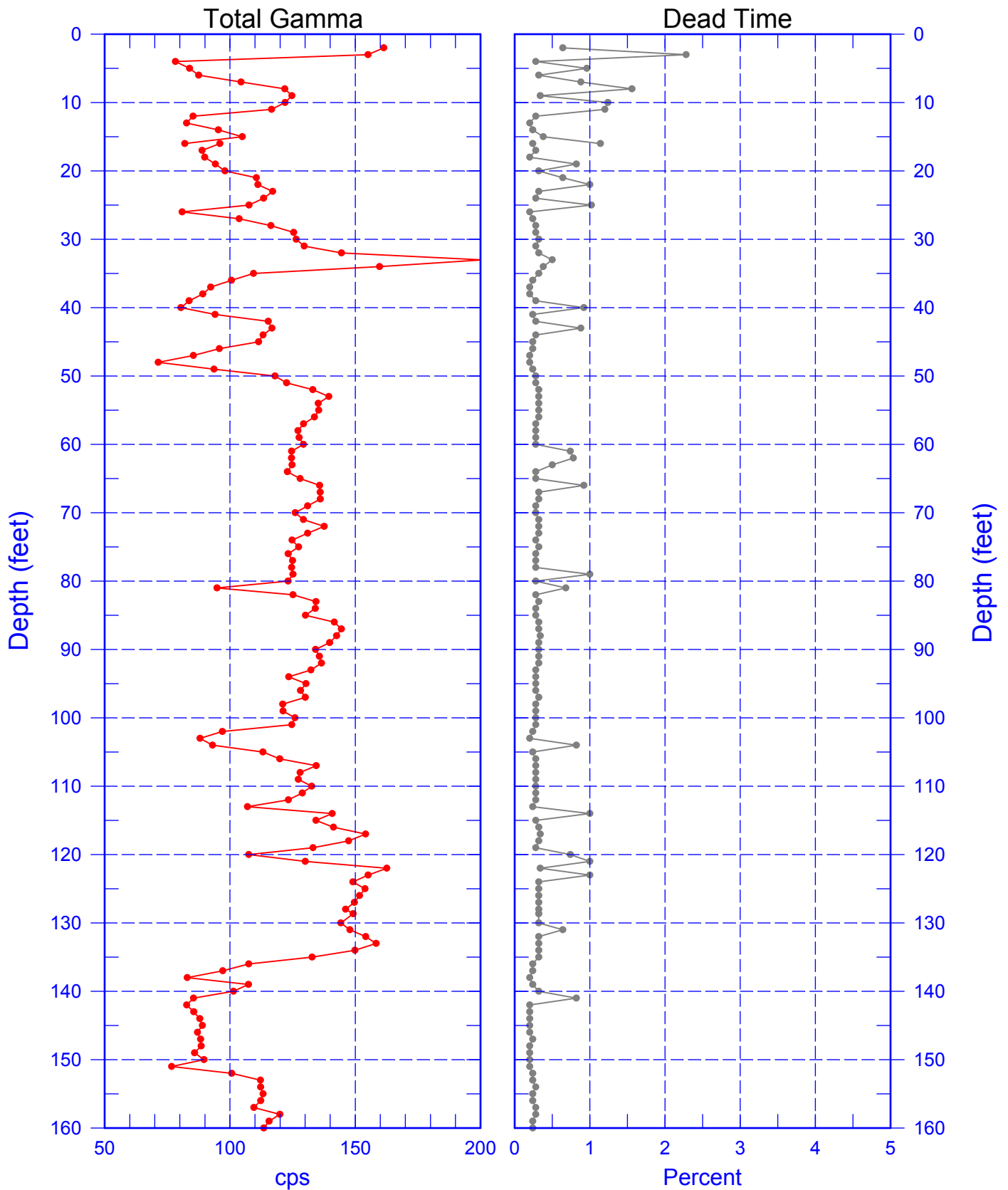
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Rerun of Man-Made Radionuclides (38.0 to 17.0 ft)



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Total Gamma & Dead Time

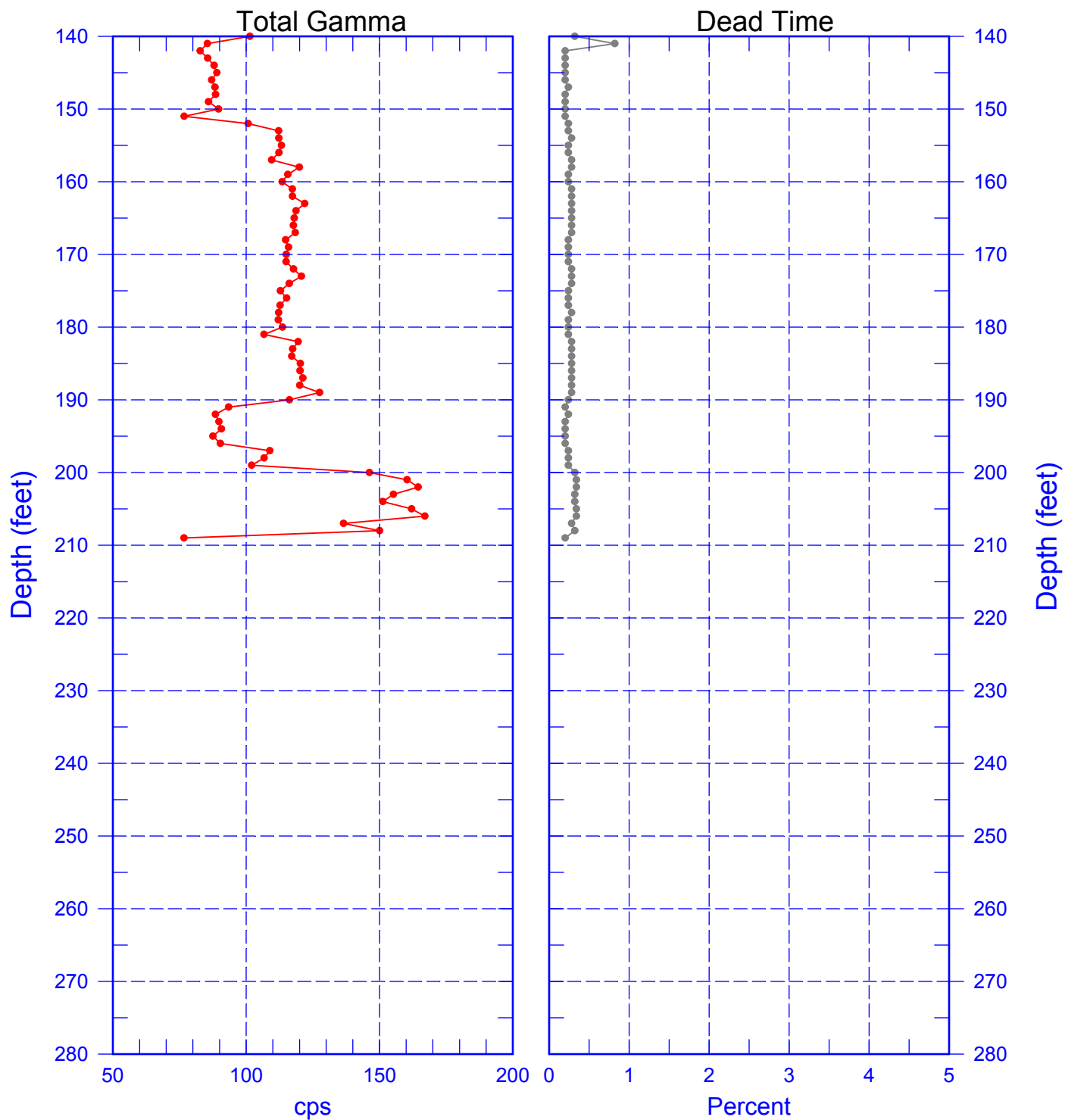


Date of Last Logging Run
5/15/2003

Zero Reference = Top of Casing

299-W26-06 (A5445)

Total Gamma & Dead Time



Date of Last Logging Run
5/15/2003

Zero Reference = Top of Casing